AMENDMENTS TO THE CLAIMS

The following is a complete listing of the claims, which replace all previous versions and listings of the claims.

1. (previously presented) A polyolefin production system, comprising:

a loop polyolefin reactor to polymerize olefin monomer in a reaction mixture to a solid polyolefin, wherein the reaction mixture comprises the olefin monomer, a catalyst, and the solid polyolefin, and wherein the loop polyolefin reactor comprises an impeller to circulate the reaction mixture through the loop polyolefin reactor; and

a temperature control system configured to control the temperature of the reaction mixture circulating through the loop polyolefin reactor, wherein the temperature control system provides a liquid coolant supply to a jacket of the loop polyolefin reactor and receives a liquid coolant return from the jacket, the temperature control system comprising a temperature control valve having a bilinear flow characteristic and disposed along a conduit of the temperature control system to modulate a flow rate of a stream of liquid coolant.

2. (previously presented) The polyolefin production system as recited in claim 1, wherein a transition region where the bilinear flow characteristic changes slope corresponds to a coolant condition for a polyolefin grade having the least demanding cooling requirement of the polymerization reactor product mix at or below design production turndown of the loop polyolefin reactor.

3. (previously presented) The polyolefin production system as recited in claim 2, wherein the loop polyolefin reactor is a polyethylene reactor, and wherein the temperature control system controls a temperature of the reaction mixture to within +/- 0.25 °C of a desired temperature of the reaction mixture.

4. (original) The polyolefin production system as recited in claim 2, wherein the coolant condition generally corresponds to 75% of normal production rate of the polyolefin grade having the least demanding cooling requirement.

5. (original) The polyolefin production system as recited in claim 1, wherein the bilinear flow characteristic changes slope at less than 50% open position of the temperature control valve.

6. (previously presented) The polyolefin production system as recited in claim 1, wherein a value of the bilinear flow characteristic is derived from a simulation model.

7. (original) The polyolefin production system as recited in claim 1, wherein the temperature control system comprises one or more controllers configured to operate the temperature control valve.

8. (previously presented) The polyolefin production system as recited in claim 7, wherein values of one or more tuning constants of the one or more controllers are derived from a dynamic simulation model.

9. (original) The polyolefin production system as recited in claim 1, wherein a calculation block that defines the output of a slave controller configured to operate the temperature control valve is derived from a simulation model.

10. (original) The polyolefin production system as recited in claim 9, wherein the slave controller is configured to operate more than one temperature control valve.

11. (cancelled)

12. (previously presented) The polyolefin production system as recited in claim 1, wherein the loop polyolefin reactor comprises at least one of a motive device, a reactant inlet, a catalyst inlet, a diluent inlet, and a polymer slurry outlet, wherein the motive device comprises the impeller.

13. (previously presented) The polyolefin production system as recited in claim 1, wherein the temperature control system comprises:

the jacket comprising one or more reactor jackets configured to thermally interface with the loop polyolefin reactor and to allow circulation of a liquid within the reactor jackets;

one or more heat exchangers configured to remove heat from the liquid;

one or more pumps configured to circulate the liquid through the one or more reactor jackets and the one or more heat exchangers; and

a plurality of conduits connecting at least the one or more reactor jackets, the one or more heat exchangers, and the one or more pumps.

14-46. (cancelled)

47. (previously presented) The polyolefin production system as recited in claim 1, wherein the reaction mixture comprises a liquid diluent.

48. (previously presented) The polyolefin production system as recited in claim 1, wherein the temperature control valve comprises:

a body comprising a port with a seat; and

a valve stem comprising a plug disposed on one end of the stem, wherein the stem is moveable between a fully closed position and a fully open position such that the plug substantially seals against the seat in the fully closed position, wherein the bilinear flow characteristic changes slope at less than 50% open position of the temperature control valve.

49. (previously presented) The polyolefin production system as recited in claim 1, wherein the temperature control system comprises a heat exchanger to remove heat from at least a portion of the liquid coolant return.

50. (previously presented) The polyolefin production system as recited in claim 49, wherein the stream of liquid coolant modulated by the control valve is the portion of the liquid coolant return processed by the heat exchanger.

51. (previously presented) The polyolefin production system as recited in claim 50, wherein the control valve is disposed downstream of the heat exchanger.

52. (previously presented) The polyolefin production system as recited in claim 49, wherein the conduit comprises a bypass conduit around the heat exchanger.

53. (previously presented) The polyolefin production system as recited in claim 1, wherein the jacket comprises a series of jackets, or parallel jackets, or a combination thereof.

54. (previously presented) A polyolefin production system, comprising:

a polyolefin reactor comprising a reactor jacket;

a coolant pump to supply liquid coolant to the reactor jacket and to receive liquid coolant from the reactor jacket;

a heat exchanger to remove heat from the liquid coolant; and

a control valve to regulate a flow rate of a stream of liquid coolant passed through the heat exchanger, wherein the control valve comprises a trim providing a bilinear flow characteristic (Cv) of the control valve that changes slope at less than a 50% open position of the control valve.

55. (previously presented) The polyolefin production system as recited in claim 54, wherein the heat exchanger is disposed downstream of the coolant pump.

56. (previously presented) The polyolefin production system as recited in claim 54, wherein at least a portion of the liquid coolant supplied to the reactor jacket comprises the stream of liquid coolant passed through the heat exchanger.

57. (previously presented) The polyolefin production system as recited in claim 54, comprising at least one bypass conduit and at least one bypass control valve around the heat exchanger to maintain substantially constant a flow rate of the liquid coolant supplied to the reactor jacket.

58. (previously presented) The polyolefin production system as recited in claim 57, wherein the flow rate of the liquid coolant supplied to the reactor jacket is substantially equal to a flow rate of the liquid coolant returned from the reactor jacket.

59. (previously presented) The polyolefin production system as recited in claim 54, comprising:

a primary controller to control temperature of a reaction mixture in the polyolefin reactor; and

a slave controller to control temperature of the liquid coolant supplied to the reactor jacket, wherein the primary control directs a set point of the slave controller, the slave controller modulating a position of the control valve.

60. (previously presented) The polyolefin production system as recited in claim 54, wherein the control valve comprises:

a body comprising a port with a seat;

a valve stem comprising a plug disposed on one end of the stem, wherein the stem is moveable between a fully closed position and a fully open position such that the plug substantially seals against the seat in the fully closed position, and wherein the trim comprises the plug and the seat.

61. (previously presented) The polyolefin production system as recited in claim 54, wherein the polyolefin reactor comprises a loop slurry polyolefin reactor.

62. (previously presented) The polyolefin production system as recited in claim 61, wherein the reactor jacket comprises a plurality of reactor jackets comprising

counter-current double-pipe heat exchangers, and wherein inner pipes of the reactor jacket comprise pipe segments of the loop slurry polyolefin reactor.

63. (previously presented) A polyolefin production system, comprising:

a slurry polyolefin reactor comprising a reactor jacket; and

a coolant system comprising:

a coolant pump to supply liquid coolant to the reactor jacket;

a heat exchanger disposed downstream of the coolant pump to remove heat from a slip stream of the liquid coolant supplied to the reactor; and

a control valve to modulate a flow rate of the slip stream through the heat exchanger, wherein the cooling valve comprises a flow characteristic (Cv) that is bilinear.

64. (previously presented) The polyolefin production system as recited in claim 63, wherein the Cv changes slope at less than 50% open position of the control valve.

65. (previously presented) The polyolefin production system as recited in claim 63, wherein the coolant system comprises:

a coolant controller to control temperature of the liquid coolant supplied to the reactor jacket, wherein the coolant controller sends an output signal to adjust the % open position of the control valve; and

a reactor controller to control temperature of a polyolefin slurry in the slurry polyolefin reactor, wherein the reactor controller sends an output signal to adjust a set point of the coolant controller.

66. (previously presented) The polyolefin production system as recited in claim 65, wherein the coolant system facilitates control of the polyolefin slurry in the slurry polyolefin reactor to within +/- 0.25 °C of a temperature set point of the reactor controller.

67. (previously presented) The polyolefin production system as recited in claim 63, wherein the control valve comprises:

a body comprising a port with a seat; and

a valve stem comprising a plug disposed on one end of the stem, wherein the stem is moveable between a fully closed position and a fully open position such that the plug substantially seals against the seat in the fully closed position.

68. (previously presented) The polyolefin production system as recited in claim 63, wherein the slurry polyolefin reactor comprises segments of pipe.

69. (previously presented) A polyolefin production system, comprising:

a slurry polyolefin reactor comprising a cooling jacket; and

a coolant system comprising the cooling jacket, a coolant pump, a first heat exchanger, and a first control valve, wherein:

the coolant pump to circulate liquid coolant through the first heat exchanger and the cooling jacket;

the first heat exchanger to cool at least a first portion of liquid coolant circulated by the coolant pump through the cooling jacket; and

the first control valve disposed along a first conduit to modulate a flow rate of the first portion of liquid coolant cooled by the first heat exchanger, wherein the first control valve comprises a bilinear flow characteristic (Cv) having a transition region at or below a 50% open valve position, such that, from the fully closed position to the transition region, the Cv is substantially linear at a first slope and, from the transition region to the fully open position, the Cv is substantially linear at a second slope greater than the first slope.

70. (cancelled)

71. (previously presented) The polyolefin production system as recited in claim 69, wherein the slurry polyolefin reactor comprises segments of pipe.

72. (previously presented) The polyolefin production system as recited in claim 69, wherein the cooling jacket comprises a plurality of cooling jackets.

73. (previously presented) The polyolefin production system as recited in claim 69, wherein the first heat exchanger comprises at least one plate and frame heat exchanger.

74. (previously presented) The polyolefin production system as recited in claim 69, wherein a cooling medium supplied to the first heat exchanger comprises cooling tower water or sea water, or a combination thereof.

75. (previously presented) The polyolefin production system as recited in claim 69, wherein the coolant system comprises a second valve disposed along a second conduit to maintain substantially constant a flow rate of the liquid coolant circulated by the coolant pump through the cooling jacket.

76. (previously presented) The polyolefin production system as recited in claim 69, wherein the coolant system comprises a second heat exchanger to heat a second portion of liquid coolant circulated by the coolant pump through the cooling jacket, and wherein the second control valve modulates a flow rate of the second portion through the second heat exchanger.

77. (previously presented) The polyolefin production system as recited in claim 69, wherein a heating medium supplied the second heat exchanger comprises steam.

78. (previously presented) The polyolefin production system as recited in claim 69, wherein the coolant system comprises a third control valve disposed along a third conduit to maintain substantially constant the flow rate of liquid coolant circulated by the coolant pump through the cooling jacket.